Supplemental Document

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Small and large scale plasmonically enhanced luminescent solar concentrator for photovoltaic applications: modelling, optimisation and sensitivity analysis: supplement

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Small and Large Scale Plasmonically Enhanced Luminescent Solar Concentrator for Photovoltaic Applications: Modelling, Optimisation and Sensitivity Analysis: supplement1

Table S1: The nomenclature used in the model

Nomenclature		Unit
Dim	Dimension	
di	Distance (spacing between MNP and luminescent molecule)	m
e_p	Dipole moment	
E	Electric field intensity	V/m
E_i	Intensity of incident electric field	V/m
G_g	Geometric gain	
L	Length	m
N_{edg}	Number of photons reaching the edge of the pLSC	
N_{inc}	Number of photons incident on top of the pLSC	
$P^L_{T.abs}$	Total power absorbed by the luminescent material	W
$P^L_{abs}(\lambda)$	Power absorbed by the luminescent material in each wavelength	W
P_{atte}	Attenuation loss power	W
P_{cone}	Escape cone loss power	W
P_{direct}	Power reaching PV directly	W
$P_{emit}(\lambda)$	Power emitted by luminescent material in each wavelength	W
$P_{T.emit}$	Total power emitted by luminescent material	W

$P_{in}(\lambda)$	Flux (power) density of the incident light	$W.m^{-2}.nm^{-1}$
$P_{lost}(\lambda)$	Power lost due to loss mechanisms including the reabsorption, escape cone, attenuation and scattering losses	W
$P_{out}(\lambda)$	Power reached to the PV cell	W
$P_{reflect}(\lambda)$	Reflected power	W
$P_{refract}(\lambda)$	Refracted power	W
$P_{re-abs}(\lambda)$	Reabsorbing loss	W
$P_{SPR}(\lambda)$	SPR power	W
P_{scat}	Scattering loss	W
P_{trans}	Transmitted power	W
P_{trap}	Trapped power	W
PR	Probability or weighted probability of an event	
PR_{abs}^{L}	Probability of absorbance by luminescent material	
PR_{abs}^{MNP}	Probability of absorbance by MNP	
PR_{atte}	Probability of attenuation	
PR_{emit}	Weighted probability from emission spectrum	
PR_{PDEF}	Probability of enhancement due to PDEF	
PR_{QF}	Probability of quenching	
PR_{QY}	Probability of emission (from QY)	
PR_{r}	Probability of reflection	
PR_{re-abs}	Probability of reabsorption	
PR_{scat}	Probability of scattering	
$PR_{T.abs}^{L}$	Luminescent material total absorbance probability	
W	Width	m
Γ_{nr}	Non-radiative decay rate	s^{-1}
Γ_{r}	Radiative decay rate	s^{-1}
Γ_{rM}	Radiative decay rate due to the MNP presence	s^{-1}
η	Refraction index of the medium	
η_0	Efficiency of bare PV cell	

θ_c	Critical angle	Degree
θ_i	Angle of incident direction	Degree
λ	Wavelength	m
τ_0	Lifetime	s
$\Psi(e_p, x_d, \lambda_{ex})$	Excitation rate	

Table S2: The acronym used in the model

Acronym	Detail
ABC	absorbing boundary condition
Ag NP	silver nano particles
Au NS	gold nano spheres
Au NS-c	doping concentration of Au NS
BIPV	building integrated photovoltaic
C	solar concentration ratio
ECE	energy conversion efficiency
FDTD	finite difference time domain
FFT	fast fourier transform
LSC	luminescent solar concentrator
MCRT	Monte Carlo ray tracing
MNP	metal nano particle
OCE	optical conversion efficiency
pLSC	plasmonically-enhanced luminescent solar concentrator
PBC	periodic boundary conditions
PCE	power conversion efficiency
PDEF	photon density enhancement factor

PML	perfectly matched layer
PV	photovoltaic
SPR	surface plasmon resonance
TIR	total internal reflection
QD	quantum dots
QD-c	doping concentration of QD
QY	quantum yield (emission efficiency of luminescent molecule)
QY_{total}	emission efficiency of the coupled MNP-luminescent molecule

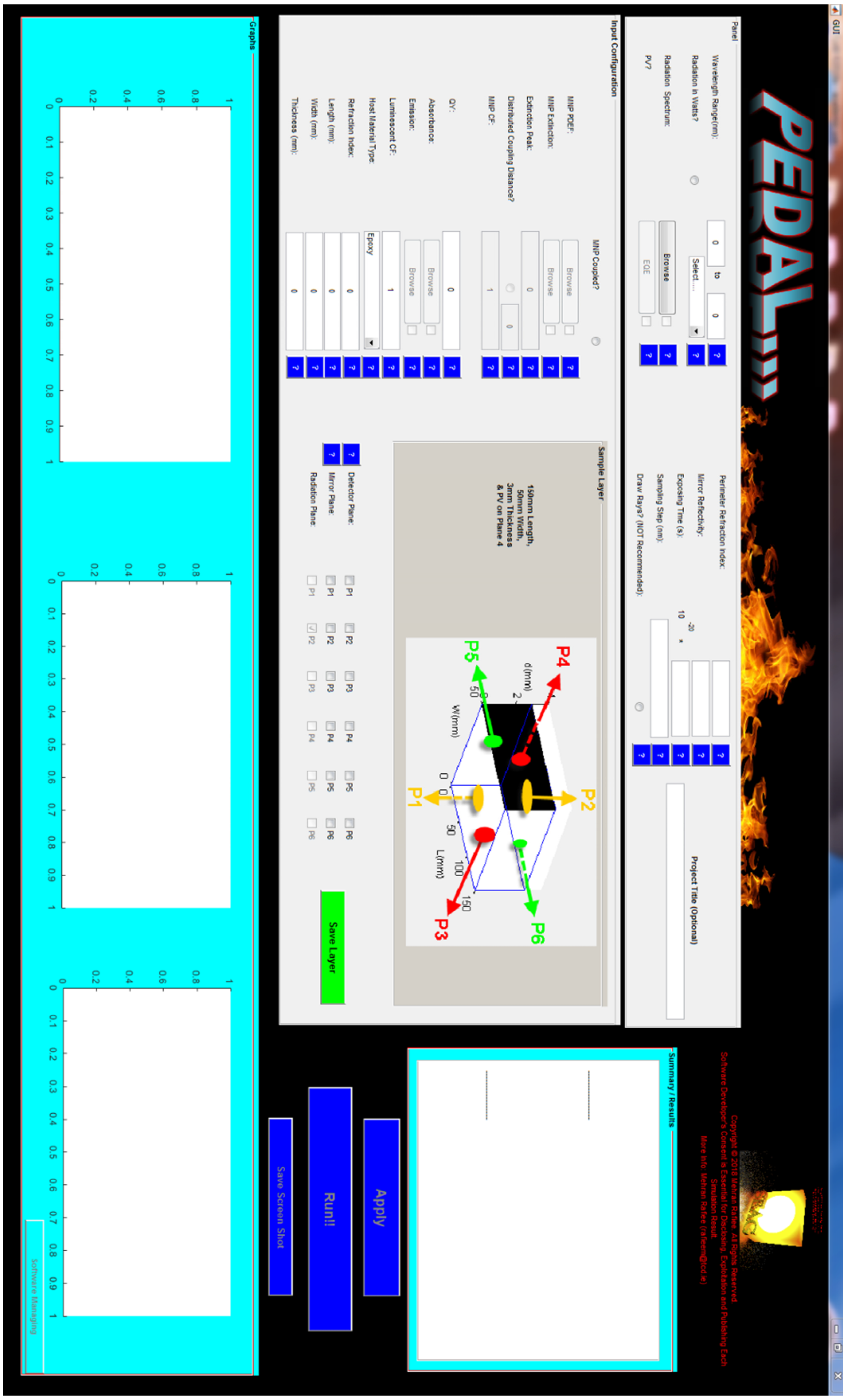

Fig. S1. Developed GUI for the 3D FDTD-MCRT model where the user is able to customize and simulate the pLSC of interest. Note: The GUI has been also designed for modelling other (single and multi-layer) luminescent solar devices including LSC as well as traditional and plasmonically enhanced luminescent down-shifting (LDS and pLDS) devices